BLUEFIN TUNA IN THE EASTERN NORTH PACIFIC OCEAN

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ABSTRACT

Northern bluefin tuna caught in the eastern North Pacific are spawned in the western Pacific and are taken with a variety of fishing gears throughout their life cycle. Total annual catches and catch per unit effort for surface and subsurface fisheries have been declining since the mid-1960s. Stock structure suggests the need for international management.

RESUMEN

Los atunes *(Thunnus thynnus)* que se capturan en la zona nordeste del Pacífico, han nacido en el Pacífico occidental, y se pescan a lo largo de su ciclo vital mediante diversos artes y redes. Las capturas anuales y por unidad de esfuerzo, tanto en las pesquerías de aguas superficiales, como en aguas más profundas, han ido disminuyendo desde mediados de la década de 1960. La estructura de las existencias sugiere que se precisa una cooperación internacional para regular esta pesquería.

INTRODUCTION

The Northern bluefin tuna was once plentiful and is still highly prized by sport and commercial fishers. One subspecies *(Thunnus thynnus thynnus)* is caught in the Atlantic Ocean; a second subspecies *(T. t. orientalis)* is caught in the Pacific. Total catches have drastically declined in both oceans, prompting management measures in the Atlantic, but not in the Pacific. Northern blue fin range throughout the Pacific, with surface fisheries near Japan and North America, and subsurface longline fisheries throughout much of the range.

STOCK STRUCTURE

Northern bluefin tuna spawn in the Philippine and South China seas from April to July (Yabe et al. 1966; Nishikawa et al. 1978). The larvae drift with the Kuroshio current towards Japan, where age 0+ (20-60 cm) bluefin are caught by the troll and bait fisheries. Many of the young fish remain in the vicinity of Japan, but a large number migrate across the Pacific and arrive off Baja California in April or May as 60-80-cm fish. Returns from tagged fish have shown these migrant bluefin to remain off the coast of North America for up to three years (Hanan 1983), whereas aging studies have shown fish as old as 6+ in the commercial catch from the eastern North Pacific (Schultze and Collins 1977). A few very large bluefin have been taken in the eastern Pacific, confirming the existence of older fish (Dotson and Graves in press); however, since no larvae have been found in the eastern North Pacific, it is hypothesized that migrant bluefin return to the western Pacific to spawn.

BIOLOGY

Northern bluefin tuna raised in captivity mature at about 3+ years, and females may carry as many as ten million eggs. Northern bluefin in the Pacific have been aged to 9+ years; large adults have only man and killer whales *(Orcinus orca)* as known predators. Hanan (1983) estimates a fishing mortality of 0.7/yr from the purse seine fishery in the eastern Pacific. Food studies in the eastern Pacific (Pinkas 1971) suggest that bluefin consume anchovy *(Engraulis mordax)*, red crab *(Pleuroncodes planipes)*, pacific saury *(Cololabis saira)*, squid *(Loligo opalescens)*, and hake *(Merluccius productus)*, in order of relative contribution to the diet. Bluefin tend to school by size in the 40-80-kg size classes, although mixed catches by size and species occur.

FISHERIES

The reluctance of northern bluefin to take a baited hook has generated a challenging sport fishery and a commercial fishery composed almost entirely of purse seiners. From 1900 to 1930, the Tuna Club of Santa Catalina Island, California, averaged 40 bluefin over 45 kg (100 pounds) annually in the sport catch. Since 1930 a *total* of only ten bluefin over 45 kg has been reported, and the average sport-caught bluefin is about 11 kg. In 1981 a commercial gill net boat caught a 237-kg bluefin near Anacapa Island, California (Dotson and Graves in press). That fish measured approximately 200 cm and would have been much older than the oldest bluefin aged from this area. In 1982 a skin diver speared a record 180-kg bluefin at Gaudalupe Island, Baja California, showing that a few large bluefin are still in the eastern Pacific.

Commercially, bluefin were first fished by purse seine about 1914; the first large catches were made in 1918 (Whitehead 1931). From 1918 to 1930, bluefin were fished almost exclusively in the Southern California Bight by the purse seine fleet out of San Pedro,

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California, and in 1930 the fishing range extended to Guadalupe Island, Baja California. In the late 1950s the high-seas bait-boat fleet began converting to purse seine gear, subsequently fishing bluefin and extending the fishing range to the tip of Baja California. From 1957 to 1969 approximately 70% of the commercial catch was made by U.S. purse seine vessels of 100-300-ton carrying capacity. With the recent increase in drift gill netting, some bluefin are now being caught in the eastern Pacific with this gear.

Northern bluefin contributes about 1% of the world tuna catch and is worth about $10 million annually. In California, bluefin is canned for an ex-vessel value just under $1200 per short ton, but its real value is in the fresh-fish market, where it is sold primarily for sashimi at an ex-vessel price of about $2000 per short ton.

Normally bluefin are available from May to October, with the first catches occurring off Baja California. The largest catches shift from the south towards the north as the season progresses (Hanan 1983); although since the 1950s most of the bluefin has been caught off Baja California.

The long-term catch histories for both the sport and commercial fisheries show decreasing trends (Table 1), and even though Mexico has had a 200-mile territorial limit for some time, they have enforced it only in the last few years, which would not account for the long-term decline in total catches. Catch per unit effort (CPUE) analysis for the eastern Pacific surface fishery and the Japanese longline fishery also shows declining trends (Hanan 1983). Although these two indicators signal caution, another method—length-frequency analysis—shows little change over time. Because of a lack of sufficient fishing-effort information from the western Pacific, and since northern bluefin is considered a single Pacific-wide stock, no further analysis of stock status has been attempted.

These disturbing trends in catch and CPUE suggest that the nations fishing northern bluefin tuna should establish the necessary data collections to determine the status of the entire stock. It may be that some preliminary management measures by the Inter-American Tropical Tuna Commission are in order.

TABLE 1
Annual Total Bluefin Tuna Landings in the Eastern North Pacific Ocean by Commercial and Sport Fisheries

Year	Commercial (MT)	Sport (#fish)	Year	Commercial (MT)	Sport (#fish)
1918	2722	*	1951	1752	7142
1919	6800	*	1952	2076	145
1920	4776	*	1953	4433	4276
1921	894	*	1954	9537	966
1922	1275	*	1955	6173	8179
1923	1460	*	1956	5727	34187
1924	1470	*	1957	9215	6428
1925	1725	*	1958	13934	884
1926	2960	*	1959	6914	1330
1927	2222	*	1960	5422	27
1928	6215	*	1961	9603	2268
1929	3414	*	1962	14651	2453
1930	9943	*	1963	14189	737
1931	1603	*	1964	10642	693
1932	486	*	1965	7556	92
1933	254	*	1966	16846	1998
1934	8327	*	1967	6601	3166
1935	11418	*	1968	6063	1231
1936	8585	2920	1969	7172	1470
1937	5758	4020	1970	4024	1833
1938	8041	11927	1971	8415	749
1939	5369	9909	1972	13390	1470
1940	9058	6878	1973	10576	5347
1941	4318	*	1974	5748	5765
1942	5826	*	1975	9578	3348
1943	4617	*	1976	10561	2040
1944	9228	*	1977	5151	1838
1945	9341	*	1978	5903	479
1946	9993	528	1979	6743	1087
1947	9452	2194	1980	3128	729
1948	2961	104	1981	1016	*
1949	1991	1841	1982	2860	*
1950	1242	27			

*No data available

LITERATURE CITED

Dotson, R. C., and J. E. Graves. In press. Biochemical identification of a new size record for bluefin tuna in California waters. Calif. Fish Game.

Hanan, D. A. 1983. Review and analysis of the bluefin tuna fishery in the eastern North Pacific Ocean. Fish. Bull., U.S. 81 (1).

Nishikawa, Y., S. Kikawa, M. Honma, and S. Ueyanagi. 1978. Distribution atlas of larval tunas, billfishes and related species—results of larval surveys by R/V *Shunyo Maru*, 1956-1975. Far Seas Fish. Res. Lab., S Series 9, 99 p.

Pinkas, L. 1971. Bluefin tuna food habits. *In* L. Pinkas, M. S. Oliphant, and I. L. K. Iverson, Food habits of albacore, bluefin tuna, and bonito in California waters. Calif. Fish Game, Fish Bull. 152:47-63.

Schultze, D. L., and R. A. Collins. 1977. Age composition of California landings of bluefin tuna, *Thunnus thynnus*, 1963 through 1969. Calif. Fish Game, Mar. Tech. Rep. 38, 44 p.

Whitehead, S. S. 1931. Fishing methods for the bluefin tuna, *(Thunnus thynnus)* and analysis of the catches. Calif. Fish Game, Fish Bull. 33, 32 p.

Yabe, H., S. Ueyanagi, and H. Watanabe. 1966. Studies on the early life history of bluefin tuna *Thunnus thynnus* and on the larva of the southern bluefin tuna *T. maccoyii*. Nankai Reg. Lab., Rep. 23:95-129.